

Integration of remote sensing observations and a web-based DSS for managing agricultural drought in heterogeneous landscapes

Jasmeet Judge, Clyde Fraisse, Karthik Nagarajan,
Chiung-Shiuan Fu – U. Florida

Marcello Moriera – Cargill

E. Hugo Berbery – U. Maryland

Daniel Rodriguez – INPE/CPTEC Brazil

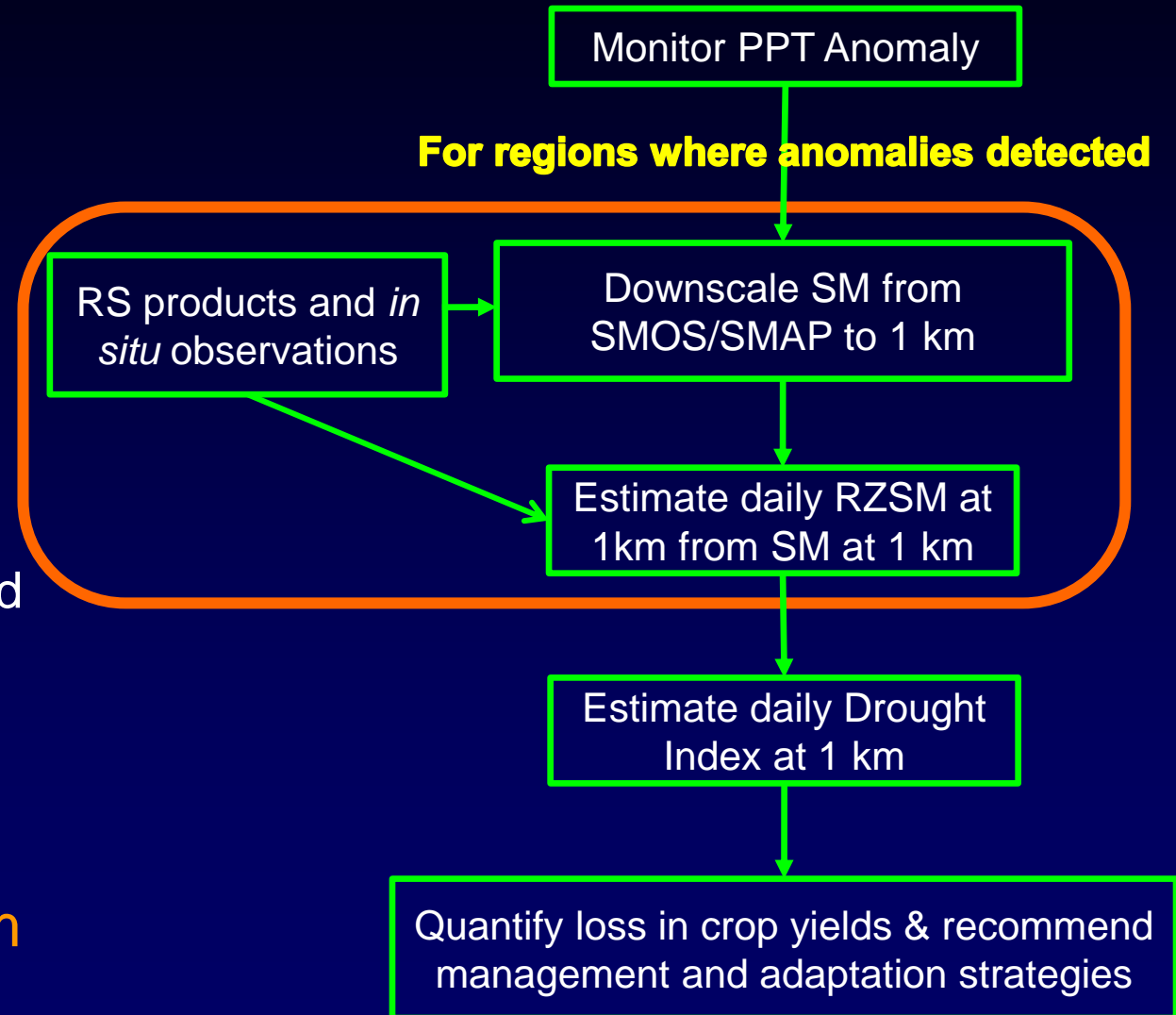


Outline

- Overview
- Methodology
- RS and *in situ* data products
- Partnerships in the region

Overview

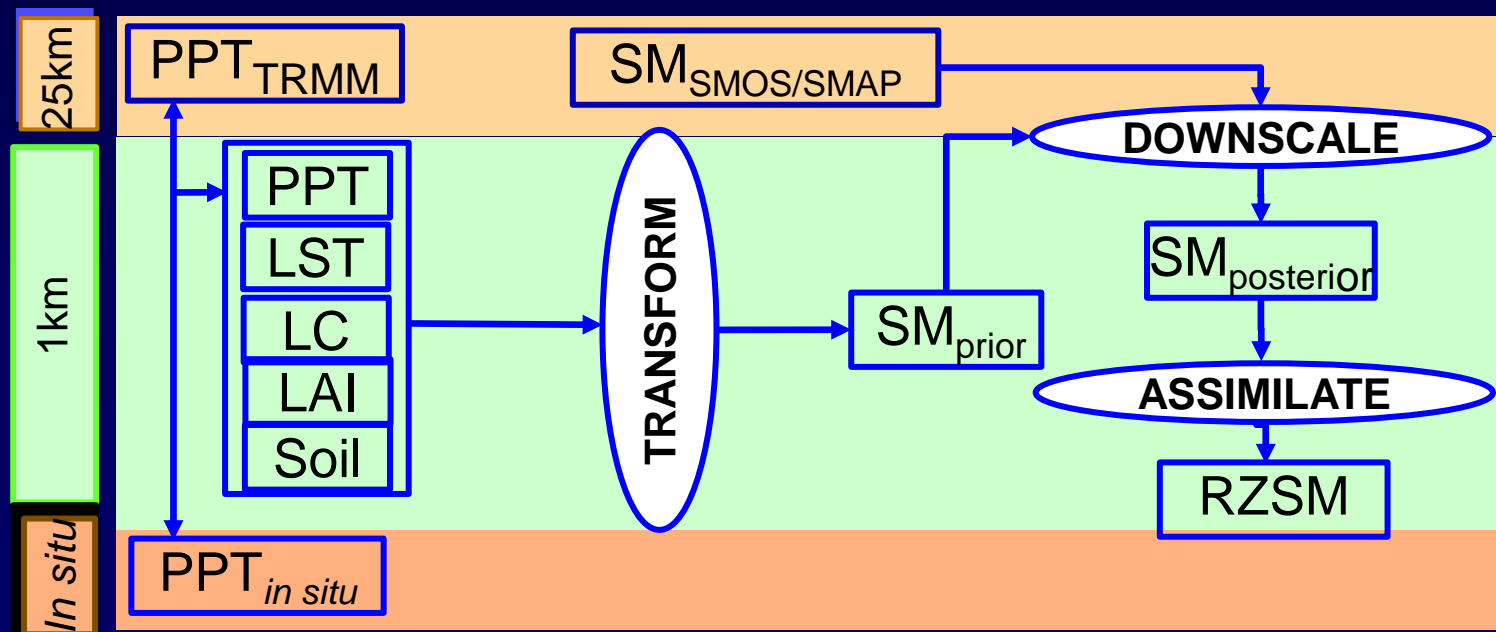
- Project started in June' 12
- Utilize RS data products at different spatio-temporal resolutions for
 - Quantifying impacts of agricultural drought on crop yield
 - Risk management and adaptation through web-based DSS
 - Soil moisture products from upcoming NASA-SMAP and current ESA-SMOS
- Soil moisture products from ESA-SMOS and NASA-SMAP



Methodology

- Step 1: Transformation

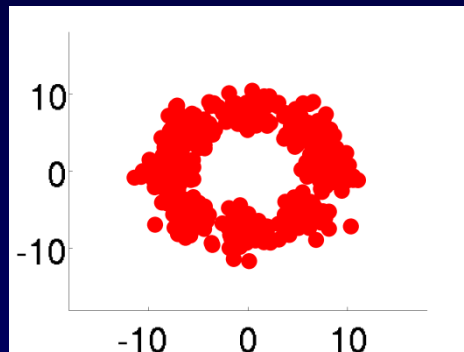
- Obtain probabilistic relationship between RS products and SM at 1km
- Discrete formulation of Bayes Rule and non-parametric methods to relate RS products to SM
- *Need training datasets for different scenarios*



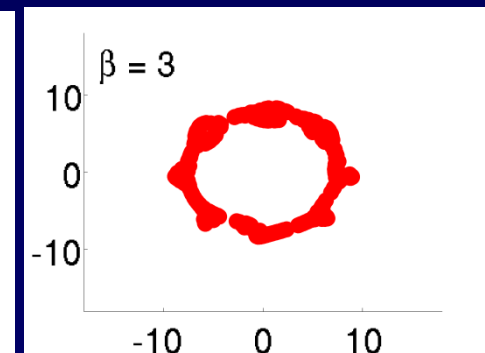
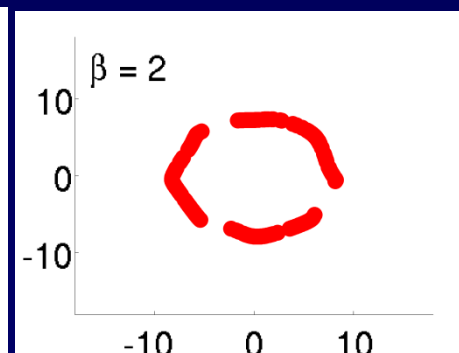
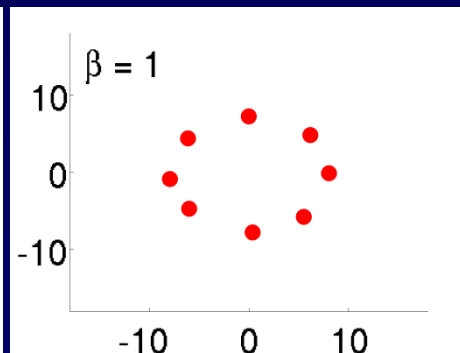
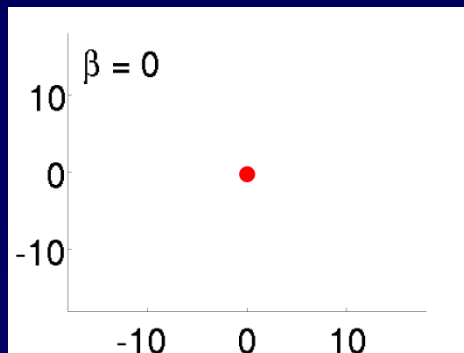
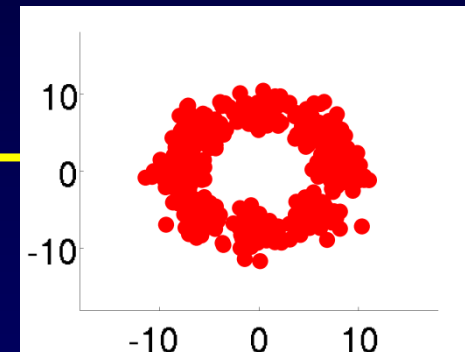
• Step 2: Downscaling

- Principle of Relevant Information (PRI) framework that simultaneously preserves information and reduces redundancy in datasets; controlled by β
- Second-order statistics are substituted by scalars and functions with information theoretic principles such as entropy, mutual information, and correntropy

S(original data)

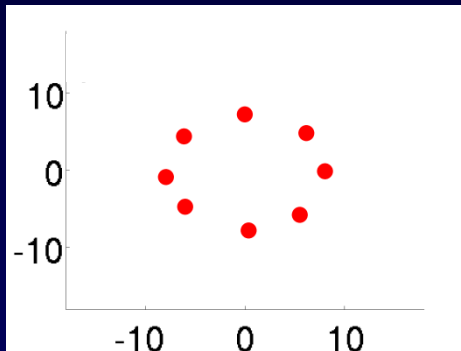


X initialized to S

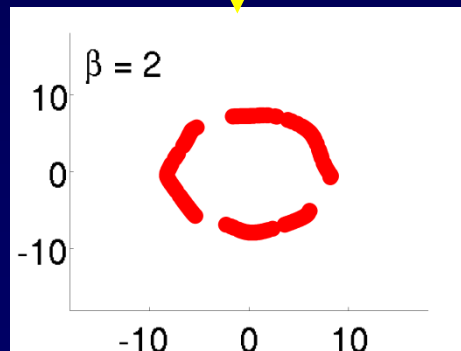
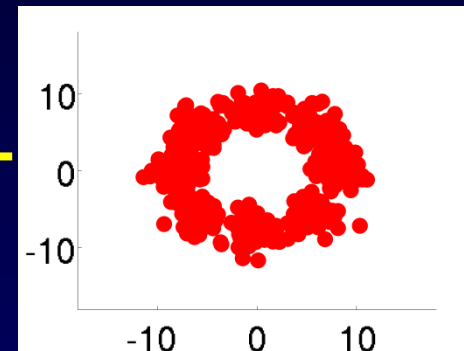


- **Step 2: Downscaling – applied to the project**
 - Coarse scale information from SMOS (25 km) or SMAP (10 km)
 - Fine scale information at 1 km from the initial SM estimate using RS products

S(Coarse resolution image)



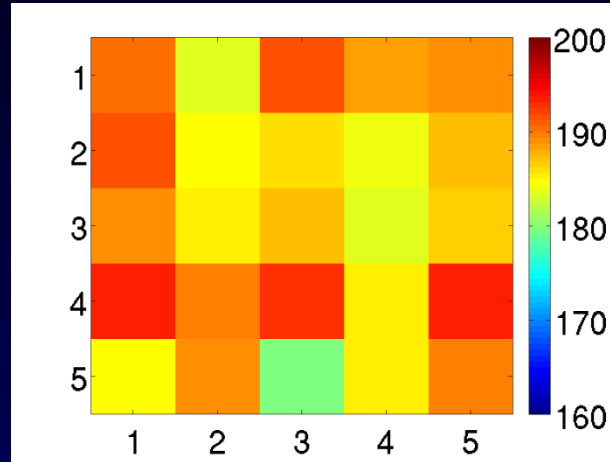
X (Prior estimates at 1 km)



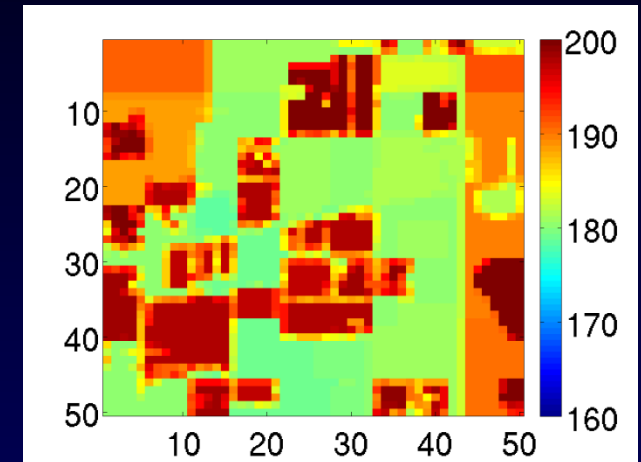
Methodology contd.

- Synthetic experiment in a dynamic, heterogeneous landscape
 - Brown: bare soil
 - Green: cotton
 - Blue: corn
- SVAT-Crop-RS model

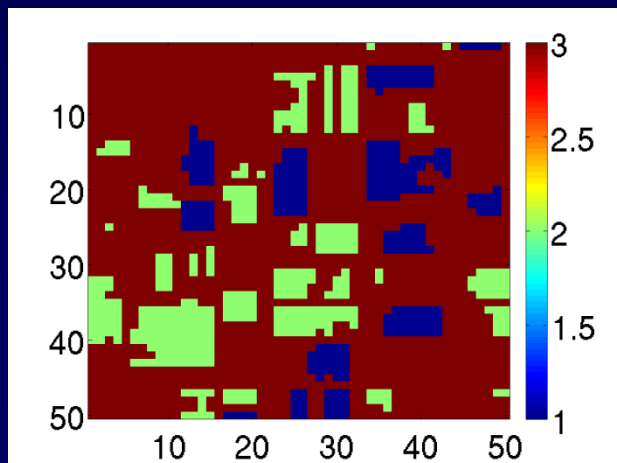
Observation at 10 km



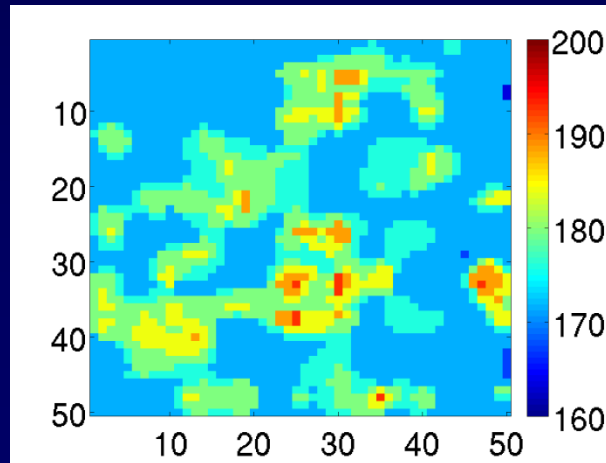
Truth at 1 km



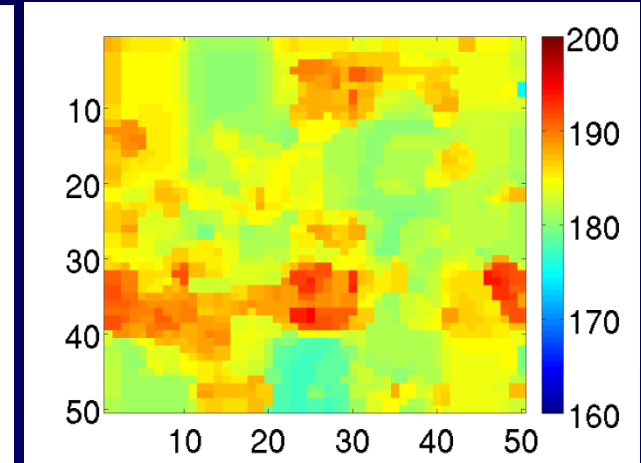
Land Cover at 1 km



Prior estimate at 1 km

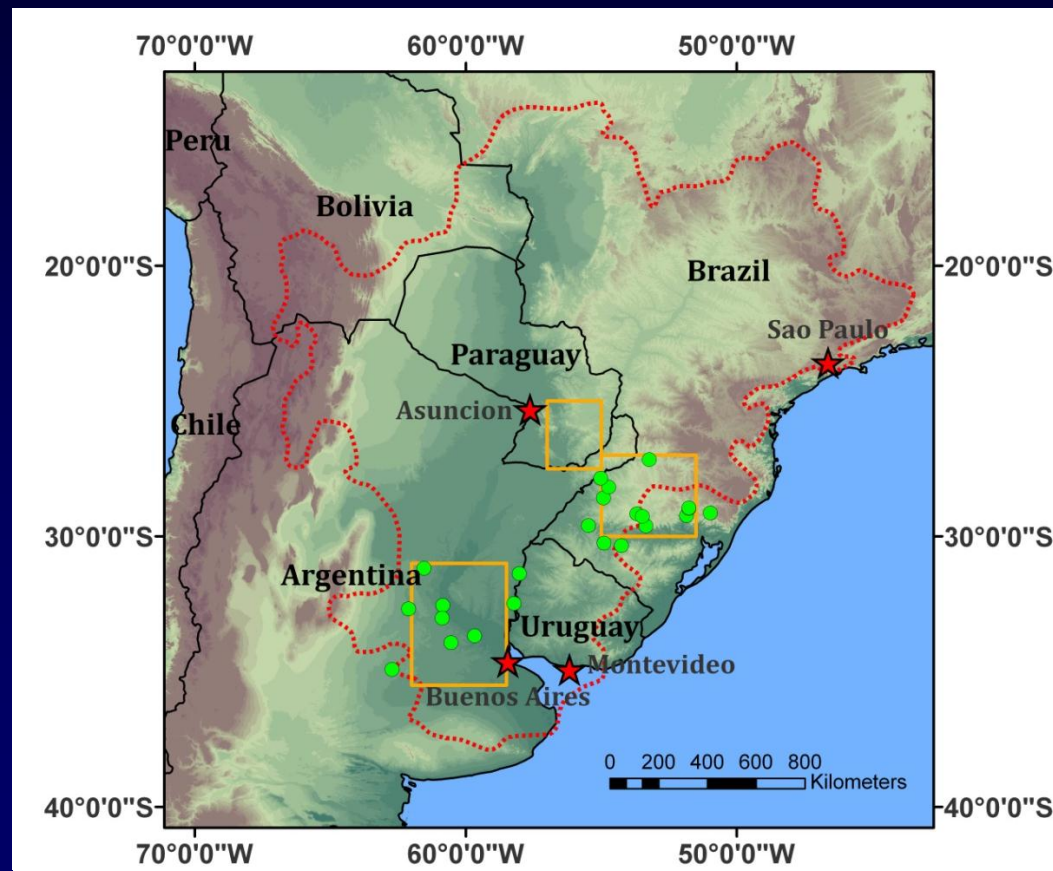


Posterior estimate at 1 km



Study Region & Data Products

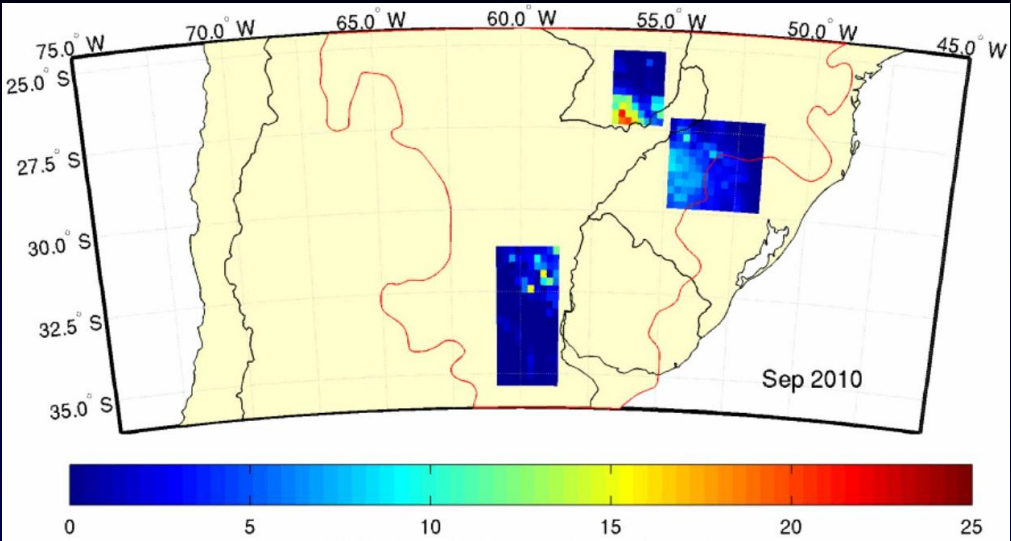
- Agricultural regions in the La Plata Basin in S. America
 - Brazil (400km), Argentina (400km), and Paraguay (150km)
 - Growing seasons: Sept through April 2010 – present; training during drought and non-drought periods
- Non-drought: 2006-07
- Drought:
 - Brazil 2004-05
 - Argentina 2007-08
 - Paraguay 2008-09
- *In Situ* Observations:
Micrometeorological, soil moisture, crop specific, and land cover



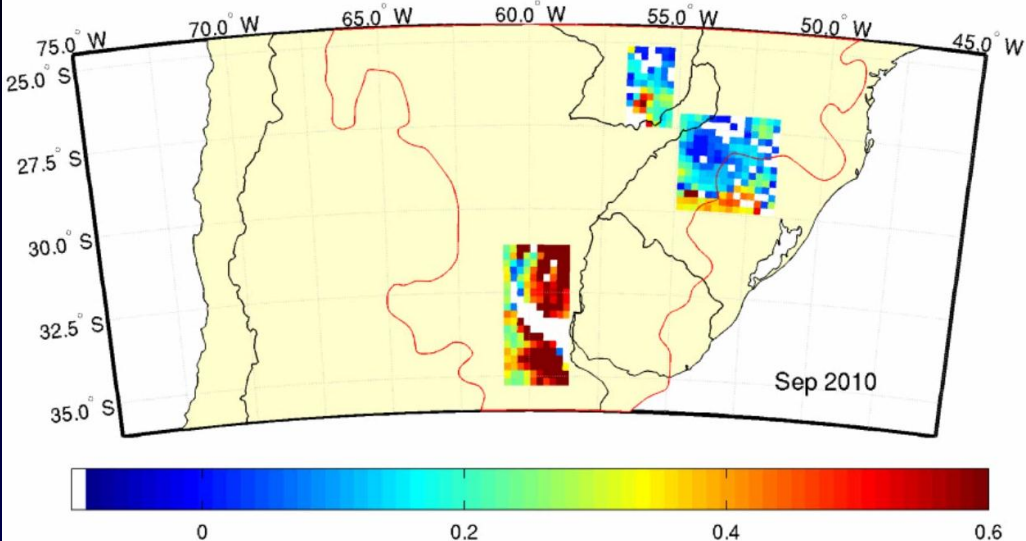
- Remote Sensing Data Products

Product	Platform	Spatial resolution	Temporal resolution
LAI	MODIS (MCD15A3)	1km	4 days
LC	MODIS (MCD12Q1)	1km	Annual
LST	MODIS (MOD11A1)	1km	Daily
PPT	TRMM (3B42)	25km	3 hours
SM	SMOS (MIR_CLF33A)	25km	2~3 days
Solar Radiation	GOES (GSIP)	12.5km	3 hours
DEM	SRTM	90m	-NA-

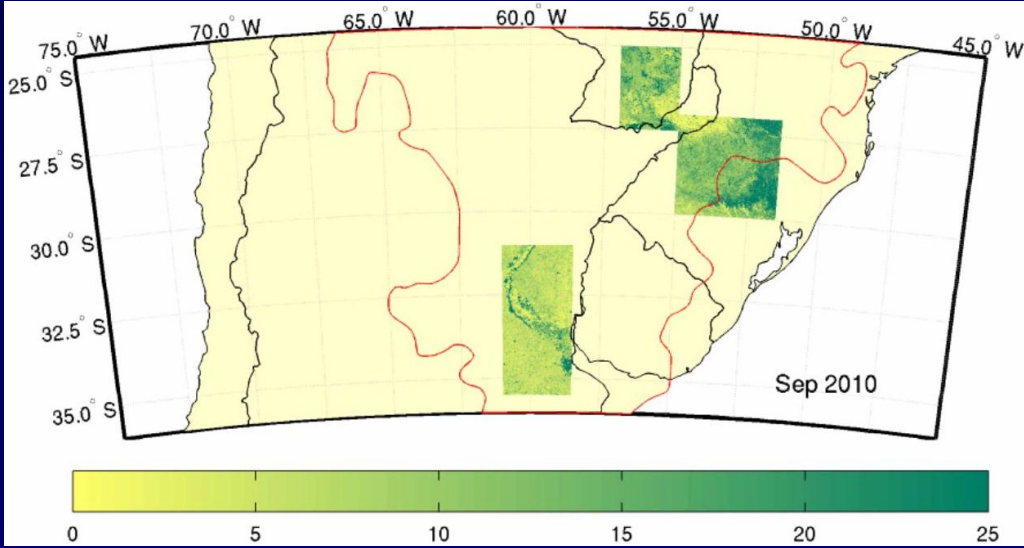
Study Regions & data products contd.



Daily precipitation (mm) from TRMM



Daily soil moisture (m³/m³) from SMOS



LAI from MODIS

Play

Pause

Partnerships

- Team members have existing projects in the region: Fraisse & Berbery
- Cargill: Partner, user, & reviewer
- INPE-CPTEC, Brazil
- EMBRAPA, Brazil
- INTA, Argentina
- FECOPROD, Paraguay: Federation of production cooperatives
- AgMIP- intercomparison of agricultural models for different regions in the world, combining climate, crop, and economic models to understand the climate impacts on food security; funded by Dept. International Development, UK; Jim Jones (UF); Cynthia Rosenzweig (Columbia U.); Jim Hansen (Columbia U.)
- Potential collaborators: University colleagues in the region
- Visit to the region in Sept/Oct

Thank You!!



Region	Non-drought	Drought
Argentina	448	263
Brazil	489	396
Paraguay	509	304

